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CLINICAL ASPECTS OF ACUTE POST-OPERATIVE PAIN MANAGEMENT & ITS ASSESSMENT

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ABSTRACT

Management of postoperative pain relieve suffering and leads to earlier mobilization, shortened hospital stay, reduced hospital costs, and increased patient satisfaction. An effective postoperative management is not a standardized regime rather is tailored to the needs of the individual patient, taking into account medical, psychological, and physical condition; age; level of fear or anxiety; surgical procedure; personal preference; and response to therapeutic agents given. The major goal in the management of postoperative pain is to minimize the dose of medications to lessen side effects & provide adequate analgesia. Postoperative pain is still under managed due to obstacles in implementation of Acute Pain Services due to insufficient education, fear of complications associated with available analgesic drugs, poor pain assessment and inadequate staff. This review reflects the clinical aspects of postoperative pain & its assessment & management with an emphasis on research for new analgesic molecules & delivery system.

Keywords: Post-operative pain management; assessment; clinical aspects.

INTRODUCTION

Effective postoperative pain control is an essential & humanitarian need of every surgical procedure. Inadequate pain control may result in increased mortality [1-2], delayed recovery & increased hospital costs. This goal is best accomplished with multinational and preemptive analgesia. A strongly held misconception is that "acute pain vanishes in a few days, and as long as the operation was successful, the acute postoperative pain will soon be forgotten".

Defination of Pain

The Taxonomy Committee of International Association for the study

of Pain (IASP) defines pain as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" [3]. Postoperative pain is considered a form of acute pain due to surgical trauma with an inflammatory reaction and initiation of an afferent neuronal barrage. It is a combined constellation of several unpleasant sensory, emotional and mental experience precipitated by the surgical trauma and associated with autonomic, endocrine-metabolic, physiological and behavioral responses [4]**.** There are number of factors which contribute for effective postoperative pain management such as a structured acute management team, patient education, regular staff training, use of balanced analgesia, regular pain assessment tools and adjustment of strategies to meet the needs of special patient groups [5]. Women require less analgesia than men. Probably due to difference in neuro-endocrine mechanism of pain relief. Neurotic patients suffer greater postoperative pain than less neurotic patients [5]. Smokers metabolize analgesics considerably faster than non-smokers [6]. The onset of the 21st century is an incredibly exciting time in pain biology. Information from recent studies in basic pain research is virtually exploding and has revealed numerous novel targets for the advent of new pain therapies.

TYPES OF PAIN

Nociceptive Pain is the signal of tissue irritation, impending injury, or actual injury. Nociceptors in the affected area are activated and then transmit signals via the peripheral nerves and the spinal cord to the brain, activated the complex spinal reflexes (withdrawal), followed by perception, cognitive and affective responses, and possibly voluntary action. Nociceptive pain is usually time limited--arthritis is a notable exception--and tends to respond well to treatment with opioids [7].

Neuropathic Pain is the result of the nervous system injury or malfunction, either in the peripheral or in the central nervous system. The pain may persist for months or years beyond the apparent healing of any damaged tissues. Neuropathic pain is frequently chronic, and tends to have a less robust response to treatment with opioids [7].

Psychogenic Pain due to the psychological factors leading to an exaggerated or histrionic presentation of the pain problem [7].

Mixed Category Pain is caused by a complex mixture of nociceptive and neuropathic factors. An initial nervous system dysfunction or injury may trigger the neural release of inflammatory mediators and subsequent neurogenic inflammation. For example, migraine headaches, myofascial pain [7].

Postoperative pain can be divided into acute pain and chronic pain. Acute pain is experienced immediately after surgery (up to 7 days) and pain which lasts more than 3 months after the injury is considered to be chronic pain. Acute and chronic pain can arise from cutaneous, deep somatic or visceral structures.

Acute pain plays some useful positive role such as to provide a warming of tissue damage and inducing immobilization to allow appropriate healing. But, pain has some short term negative effects such as sleep disturbance, cardiovascular side effects, increase oxygen consumption, impaired bowel movement, delays mobilization and promotes thromboembolism. Management of post postoperative pain has generally been shown to be inadequate.

It is important to distinguish between first pain and second pain.

First pain is sharp, and "pricking". It localises to a well-defined part of the body surface mediated by specific "nociceptors".

Second pain is dull, arching poorly localised due to stimulation of receptors that exist in many tissues (except brain).

PHYSIOLOGY OF PAIN

The spinal cord is the main part of the body's central nervous system that conveys signal from the brain to the nerves throughout the body. Nerves coming from and leading to all parts of the body enter and exit the spinal cord along its entire length. There are 31 pairs of spinal nerves that exit the spinal cord through openings between the vertebrae. The point at which the nerve exits the spinal is called the nerve root, and where it branches and into many smaller nerves that control different part of the body is called peripheral nerves. The peripheral nerves include both motor and sensory nerves. Sensory nerves are nerves that receive sensory stimuli. Motor nerves lead to the muscles and stimulate movement.

Various mechanisms are;

Nociception refers to the processing of a noxious stimulus resulting in the perception of pain by the brain. The components of nociception include transduction, transmission, modulation and perception. Hyper responsiveness (increased sensitivity) is a hallmark feature of both acute and chronic pathologic pain. This is a result of changes in the nervous system response (neuroplasticity) at peripheral and central locations (Figure 1).

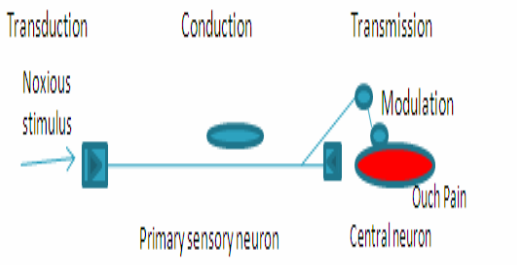

Fig. 1: Process of Nociception

Peripheral sensitization occurs when tissue inflammation leads to the release of a complex array of chemical mediators, resulting in reduced nociceptor thresholds. This causes an increased response to painful stimuli (primary hyperalgesia).

Central sensitization refers the responses in the CNS are primarily physiological.Central sensitization is a physiological process and only if there is continual firing of C-nociceptors overtime will these processes leads to more chronic pain syndromes. (Figure 2).

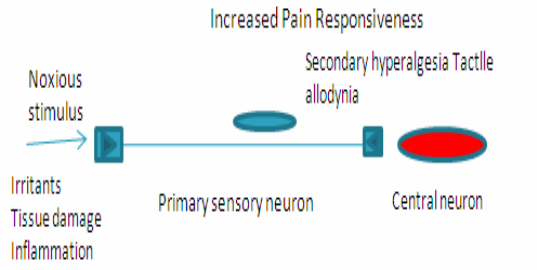

Fig. 2: Process of Central Sensitization

PATHWAYS OF PAIN

Pain pathways were seen as having three components:-

A first order neurone (cell body in dorsal root ganglion) which transmits pain from a peripheral receptor to a second-order neurone.

A second-order neurone in the dorsal horn of the spinal cord, which axon crosses the midline to ascend in the spinothalamic tract to the thalamus where a third neurone.

A third-order neurone projects to the postcentral gyrus (via the internal capsule).

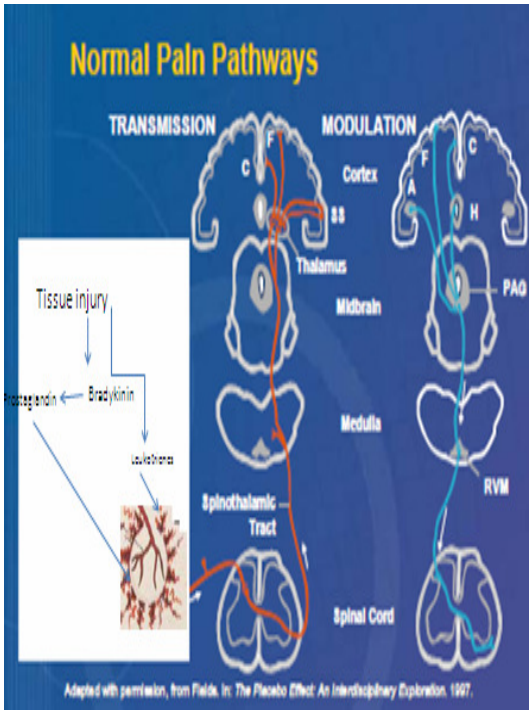

Fig. 3: Normal Pathways of Pain

Peripheral receptors

There is some evidence that neurotransmitters such as substance P (=sP), vasoactive intestinal polypeptide (VIP) and calcitonin gene-related peptide are important mediators, either as neurotransmitters, or sensitisers of visceral pain receptors.

Prostaglandins, histamine, serotonin, bradykinin, ATP, potassium, and H+ ions also appear important in this regard, especially serotonin, which appears to act mainly on 5HT3 receptors.

In terms of pain perception, thresholds for feeling pain are remarkably constant

from individual to individual. i.e. Peripheral receptor stimulation of sufficient intensity will reproducibly cause pain at the same level in most people.

The response of the individual, and his tolerance of the pain, will however differ markedly between individuals. Of great interest is "Neurogenic Inflammation". Here, stimulation of C fibres causes a local reaction consisting of vasodilatation and increased capillary permeability.

This is due to retrograde transport and local release of sP and calcitonin gene-related peptide. As a consequence, K+, H+, acetylcholine, histamine and bradykinin may be released, and these in turn cause prostaglandin and leukotriene production (which may end up sensitizing high-threshold mechanoreceptors.

Analgesic drugs that act peripherally include non-steroidal anti-inflammatory agents, corticosteroids, local anaesthetic agents (which may theoretically inhibit neurogenic inflammation if given early enough, an area of great controversy), and even novel drugs such as substance P antagonists.

ASSESSMENT OF ACUTE PAIN

Acute pain often has an obvious cause, for example following trauma, surgery, or the onset of a well-recognized disease process (e.g. myocardial ischaemia, pancreatitis). Acute pain may be of nociceptive or neuropathic origin. Pain described as burning, stabbing, or like an electric shock suggests a neuropathic origin. In one of the study of a patient-based national survey on postoperative pain management in France reveals that pain intensity monitoring was prescribed for only 2 % of cases. However, written postoperative pain evaluation was frequent in surgical wards 93.7%, at intervals of 4.1 h. Preoperative pain was reported at the site of surgery in 62.7% of patients. This preoperative pain, when present, had existed for more than a year in 35.6% of patients. Patients reporting preoperative pain had significantly more intense postoperative pain at rest (ANOVA, p=0.0002) and when moving (ANOVA, p-0.001) than patients without preoperative pain. Severe pain was present in 4.2% of patients at rest, 26.9% of patients during movement and maximal pain since surgery was severe in 50.9% of patients [8].

A Simple code for pain scoring in the postoperative set up is:

Comfortable (awake or asleep)

Slight pain - only elicited by close questioning

Moderate pain- bothering the patient, But often controllable by lying still. The patient may ask for analgesia

Severe pain- dominating the consciousness and calling out for urgent relief [9].

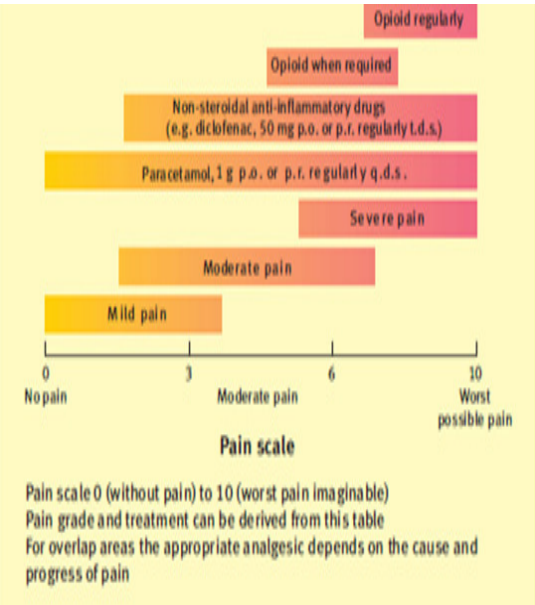

Fig. 4: Acute pain relief treatment chart

Visual analogue scale

It is the most common simple scale, used in pain research. It consists of a 10 cm line with two anchor points of 'no pain' and 'worst pain imaginable' which is self assessed by patient. The visually impaired, young children and cognitively impaired adults may have problems with the concept (Figure 5).

Fig. 5: Visual Analogue Scale

Numerical rating scale

It is similar to the visual analogue scale with the two anchors of 'no pain' and 'worst pain as from 0 to 10 (making an 11-point scale), assessed by patient (Figure 6).

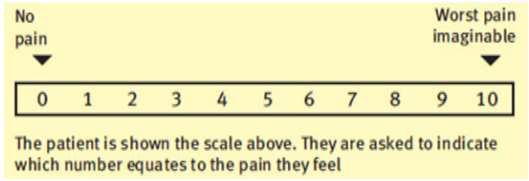

Fig. 6: Numerical Pain Scale

Verbal rating scale

It is usually has four points: no pain, mild pain, moderate pain, and severe pain. It is easy to use and can be used in the mildly cognitively impaired, but it is insensitive to small changes in pain intensity.

Multidimensional pain scales

The most common multidimensional pain scales are the McGill Pain Questionnaire, and the Brief Pain Inventory, but many others are available. One of the main reasons for multidimensional pain assessment is to establish a 'problem' list that does not just include pain intensity, but also includes mood, behaviors, thoughts and beliefs, physiological effects, and their interaction with each other. The clinician is then directed to treat all aspects of the pain experience [10].

McGill Pain Questionnaire

Melzack and his team in McGill University designed this questionnaire in the early 1970s redeveloped in 1980. The first 11 words describe the sensory dimension and the next four the affective dimension [10].

Brief Pain Inventory

This assessment form is often used and has been translated into several languages. It initially assesses pain intensity at its worst, best, and at the time of the evaluation. It further assesses the percentage relief from current medications or treatments, and the duration of the relief. It enquires about exacerbating and relieving factors. Aspects of pain belief are evaluated and the level of interference with normal daily living is assessed. A short form of the Brief Pain Inventory is also available. Its disadvantages are that it is a lengthy form to complete and it is unsuitable for those with cognitive impairment [10].

The Memorial pain assessment card

It was developed as a rapid multidimensional pain assessment tool in cancer patients and uses three separate visual analogue scales to assess pain, pain relief, and mood. The card also has a set of adjectives for pain intensity. This measurement tool has the advantage that it takes very little time to administer and that the results correlate with other, longer evaluators of pain and mood. The card should be folded so that only one scale is presented to the patient at a time.

Neuropathic pain scale

It is a specific assessment tool for neuropathic pain developed by Galer and colleagues. It uses eight pain descriptors or pain quality items (sharp, hot, dull, cold, skin sensitivity, itching, deep and surface pain), plus a global measure. It also measures unpleasantness, using a scale of 0 to 10.

Table 1: Pain assessment for children under four years

Cry	Not Crying	Score 0
	Crying	Score 1
Posture	Relaxed	Score 0
	Tense	Score 1
Expression	Relaxed or happy	Score 0
	Distressed	Score 1
Response	Responds when spoken to	Score 0
	No response	Score 1

Specific difficulties with pain assessment

Cognitively impaired older patients: Behavioural tools are advocated for those who are cognitively impaired and unable to report pain verbally.

Drug abusers: fear of prescribing to opioid abusers often leads to inadequately treated pain. Assessment and treatment are particularly difficult in this group and referral to specialists is recommended.

POSTOPERATIVE PAIN MANAGEMENT

Non-pharmacological methods of pain relief

Preoperative explanation and education, Relaxation therapy, Hypnosis, Cold or heat, Splinting of wounds, Transcutaneous electrical nerve stimulation (TENS).

WHO Analgesic Ladder

For Mild: Non-opioids (eg. NSAID's, paracetamol)

For Moderate: Weak Opioids (eg. codeine) with or without non-opioids.

For Severe: Strong Opioids (eg. morphine) with or without non-opioids.

MECHANISM OF PAIN KILLERS

At the site of injury, the body produces prostaglandins that increase pain sensitivity. Aspirin, which acts primarily in the periphery, prevents the production of prostaglandins. Acetaminophen is believed to block pain impulses in the brain itself. Local anesthetics intercept pain signals traveling up the nerve. Opiate drugs, which act primarily in the central nervous system, block the transfer of pain signals from the spinal cord to the brain.

ADVANTAGES OF TECHNIQUES OF REGIONAL ANALGESIA

Continuous Epidural Analgesia (CEA)

Advantages

Very effective

Much experience

Reduces the quantity of opioid analgesics needed.

Disadvantages

Motor block and urinary retention block

Regular clinical monitoring on surgical wards.

Continuous Peripheral Nerve Blocks (CPNB)

Advantages

Better efficacy than parenteral opioids.

Incidence of side-effects less than epidural.

Diadvantages

Slower learning curve than single shot techniques.

Higher incidence of technical problems compared to single shot techniques.

Incisional catheter techniques

Advantages

Simple technique

Promising results for pain management lower abdominal procedures.

Disadvantages

Relatively newer technique.

Further studies needed to evaluate safety.

CLINICAL USE OF THESE ANALGESICS WHICH ARE ADMINISTERED DURING SURGERY

Analgesics were administered intraoperatively in 63.6% of patients. Non-opioid analgesics, including paracetamol 82.3%, ketoprofen 39.6%,

Table 2: Pharmacological methods of pain relief

Type of Pain	Treatment Options	Dose	Negative points of treatment	Comments	Efficacy
Mild Intensity Pain -Inguinal hernia -Varices -Laparoscopy	Paracetamol	4*1g(Orally)	Nausea, Sickness	Should be combined with NSAID or opioids	Mean reduction in visual analogue scale pain intensity scores at 30 minutes was 43 mm [11].
	NSAID's -Diclofenac -Ketrolac	75-150mg (orally, I.V.) 10-30 mg (Orally, I.V.)	G.I.T Complaints. Headache, Abdominal pain	Should be combined with Opioids. -Low bioavailability	40–48% improvement in variable score [12]. 5-21% improvement in variable score [13].
	Regional Block Analgesia -Weak Opioid Codeine	3mg/kg/day	Sedation, G.I.T complaints	Analgesic action is likely due to conversion to morphine	24.6% pain relief in variable score
	Tramadol	50-100mg (6 hourly)	Respiratory Complaints, Sedation	It reduces serotonin and nor epinephrine reuptake	12.7% pain relief in variable score [14]
Moderate Intensity Pain -Hip replacement - Hysterectomy -Jaw surgery	Paracetamol	4*1g(Orally)	Nausea, Sickness	Should be combined with NSAID or opioid	Mean reduction in visual analogue scale pain intensity scores at 30 minutes was 43 mm [11].
	NSAID's -Ibuprofen	600-1200mg (Orally)	salt and fluid retention, nausea, G.I.T problems	Low Bioavailability	5.9% pain relief in variable score [15].
	Perpheral Nerve Block -Opoid Injection (Pethidine)	5-25mg (bolus)	Constipation, Dry mouth, Nausea	Cardiotoxic	24.1% pain relief in verbal rating score [16].
Severe Intensity Pain -Thoracotomy -Upper abdominal surgery	Epidural local analgesia or strong Opioids	0.5-2.5 mg(bolus)	Constipation, Addiction, Withdrawal	No other opioid or sedative drug should be administered	Mean reduction in visual analogue scale pain intensity scores at reduces 40 mm

were frequently used during surgery. Intraoperative opioids were used less frequently than non-opioid analgesics. The opioid analgesics used were intravenous infusions of tramadol 11.5%, morphine 14.1% or subarachnoid morphine 4.9% at a low dose 98 µg. Ketamine was used as an intraoperative antihyperalgesic 9.2% [8].

Side effects since surgery

The incidence of sedation, pruritus, urinary retention and motor block as estimated by the patient differed from that estimated from monitoring by nurses [8].

Problems with Current delivery system use for Post-Operative Pain Management

Multiple dosing for 1 week to 2 months, depending on severity of the pain.

Disadvantages of local anaesthetics/Opioid derivatives:

Constipation, Dry mouth, Nausea, Hallucination, Convulsions,

Respiratory depression, hypotension, Confusion, Addiction, Withdrawal

Disadvantages with Oral formulation of NSAID's:

Acidity or burning sensation, GIT bleeding, Nausea, Sickness etc.

Disadvantages of Conventional Injectable NSAID's:

Rapid action but short duration, so sufferings of repeated injectable dosing.

Swelling of veins or muscular region

Allergic reactions & Pain at site of injection

Acidity or burning sensation, GIT bleeding, Nausea, Sickness etc.

NEED FOR NOVEL SUSTAINED DELIVERY FORMULATIONS

To meet the needs of individual patients for enhancing the quality of postoperative pain management, novel drug delivery are the effective drug delivery systems to improve the therapeutic efficacy of drugs by increasing drug circulation times, facilitating targeting of drugs, and enhancing stability without compromising safety or tolerability. The sustained release of novel delivery may improve tolerability because of the extended drug delivery. The extended release formulation allows for single administration of a high drug dose with sustained release and targeted delivery. Extended-release preparation has proved effective drug delivery vehicle for morphine sulfate; extended-release MVL morphine sulfate exhibits an extended duration of pain relief for up to 48 hours postoperatively without compromising safety or tolerability, according to initial clinical studies. This type of combined approach is well documented to improve the quality of the recovery process and reduce the

hospital stay and postoperative morbidity, leading to a shorter period of convalescence after surgery.

CONCLUSION

Advances in pharmacology, techniques such as use of sustained delivery, and education are making major inroads into the management of postoperative pain. Nursing education, patient care, and physician responsiveness will be key to the success of any pain management improvement initiative.

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